Bill Nye the Science Guy

Time

Table of Contents

1. **Implementation Guide** 2–9

   This descriptive guide will assist you in integrating the DVD math and education content into your instructional program.

2. **National Mathematics Education Standards** 10-11

   See the Principles and Standards for School Mathematics (PSSM)) correlated for this program.

3. **Episode Guide** 12-15

   Previewing questions, background information, suggested activities and internet resources are included to extend student learning.

4. **Lesson Planning Worksheet** 16-17

   This template helps you incorporate all the features of the Bill Nye DVD into your daily lesson plans.

5. **Graphic Organizer** 18

   A graphic organizer can be used to assess students' prior knowledge and what they learned.

6. **Student Problem Solving Sheet** 19-20

   This handout gives you a standardized format that students can fill out as they solve a problem.

7. **Glossary** 21-22

   Use the terms and definitions found here to assist you in direct vocabulary instruction. The glossary terms are also found on the DVD.

8. **Quiz** 23

   This written version of the interactive quiz on the DVD provides a ready-to-go written test. Multiple choice and true-false items address key concepts found in the standards and in the program.

9. **Quiz Answer Key** 24

   A separate page contains the quiz answer key.

© Disney

Implementation Guide

Welcome to Disney's Bill Nye DVD collection! With the help of this Guide you can bring instructional DVDs into your math curriculum.

What's on the DVD?

Bill Nye DVDs expand the educational features of *Bill Nye the Science Guy* programs. Each DVD provides students with science content through video clips aligned with *Principle and Standards for School Mathematics (PSSM)* and a host of other resources.

Short video clips aligned with the (PSSM) provide a unique opportunity for you to enhance your lessons using DVD technology. Now you can show a video clip, or even short segments of a clip, on command. But there are a host of other features, too! See the chart below for a summary.

From the Main menu, there are three chief sections:

Feature	Description
Watch Program Menu	From this menu, you can play the program straight through or use the clips to customize your viewing.
Teacher Support	From this menu, you can access this Teacher's Guide, the Glossary, Internet Links, and the Quiz.
Bonus Materials	Use this menu to try a different discussion starter, download a special screen-saver, or check out never-before-seen footage.

From the Watch Program menu, you can:

Feature	Description
Play Program	Play the entire program from start to finish.
Bilingual Mode	View the entire program or clips in English or Spanish.
Glossary Mode	Make links to Glossary terms appear during the program.
Program Overview	View the program introduction, in which Bill discusses the topic covered.
Try This	Show students demonstrating science concepts.
Bill's Demonstration	Look at a demonstration conducted by Bill Nye.
Music Video	Enjoy a short music video that summarizes the topic in an age-appropriate and entertaining manner.
Math Standards	Take advantage of short video clips from the program, which are aligned with Principles and Standards for School Mathematics.

© Disney

From the Teacher Support menu, you can:

Feature	Description
Quiz	Give students a quiz to take independently or as a class. Ten quiz items are aligned with national standards. The items are in multiple-choice or true-false format. Each wrong answer links to a standards-aligned video clip. At the end of the quiz, a scoring function reveals the number of correct initial answers.
Glossary	Check out definitions of key terms and view video clips that reinforce the concepts.
DVD Features	View a quick overview of the features found on the DVD.
Teacher's Guide	Print out or view this comprehensive Teacher's Guide in PDF format.
Internet Link	Link to the Bill Nye area of Disney's Edustation Web site, where you can find links to Internet sites related to the content of each Bill Nye program.

From the Bonus Materials menu, you can:

Feature	Description
Bonus Material	Find out what *wasn't* in the episode! In most cases, there's more of the Way Cool Scientist interview, Bill Nye outtakes, and an extra discussion starter.
Additional Clips	See trailers of related DVDs and videos.
Screen-Saver	Download this cool screen-saver for your computer.

The Planning Process

This Guide provides a Lesson Planning Worksheet (see page 16), which can assist you in setting up your instruction around a topic. The following sections of this Implementation Guide are offered to assist your planning process:

- **Determining Objectives and Linking to Standards**
- **The Learning Cycle**
  - **Explore**
  - **Apply**
  - **Extend**
  - **Assess**

© Disney

Determining Objectives and Linking to Standards

1. Select content and adapt and design activities to meet student interest. The PSSM Teaching Principle states that "Selecting and using suitable curricular materials, using appropriate instructional tools and techniques…are actions good teachers take everyday." The Principle goes on to state that, "Teaching mathematics well involves creating, enriching, maintaining, and adapting instruction to move toward mathematical goals, capture and sustain interest, and engage students in building mathematical understanding." The Bill Nye DVD provides good mathematical content in a fun and engaging way for students of all ages.

   Each DVD contains a menu of clips that are Math aligned with PSSM. You can review the standards and their aligned clips in the Standards menu under Watch Program. Also, the Standards listed on page 10 of this Guide allow you to look at additional PSSM content standards that are addressed on the video. Since most state and local standards documents were derived from the PSSM, you will find that your local and state standards match closely with content standards in the Bill Nye DVD. Here's an example of the content standards and clips aligned with the Bill Nye DVD entitled *Measurement*:

Mathematics Standards (PSSM) Addressed in Measurement

Measurement:
Understand measurable attributes of objects and the units, systems, and processes of measurement

- **Understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems.**

  Aligned clips:

  - **1 Great moments in measurement**
  - **2 A meter is a meter wherever you are**

- **Understand relationships among units and convert from one unit to another within the system.**

  Aligned clips:

  - **3 A meter to a liter to a kilogram**
  - **4 Meter/centimeter/millimeter/micrometer**

  Apply appropriate techniques, tools, and formulas to determine measurements.

- **Select and apply techniques and tools to accurately find length, area, volume, and angle measures to appropriate levels of precision.**

  Aligned clips:

  - **6 Construction and airplane manufacturing**
  - **7 Bridge**

© Disney

2. Determine your objectives for the lesson and how these objectives address the standards.

Sample Objectives for *Measurement*

In this activity students will:

- **Compare the origin of the metric system with the customary system.**
- **Distinguish between standard and nonstandard measurements.**
- **Explain how meters, liters, and kilograms are related.**
- **Define the metric prefixes as based on powers of ten.**
- **Convert from one unit to another within the metric system.**
- **Measure length, volume, and mass of common objects using appropriate units.**

3. Design a learning cycle of instructional experiences and assessments for the students to engage in that will help students meet these standards. Students may be given teacher-planned investigations or may be guided to design their own investigations.

The Learning Cycle

The learning cycle is a sequence of activities that involve students in the learning process. The sequence found here is based on research from Lawson**,** Abraham, and Renner published in 1989. That has been adapted to include: Explore, Apply, Extend and Assess:

Explore: Involves assessing students' prior knowledge and providing opportunities for students to interact with content from the video.

Apply: Includes having students use the content learned during the Explore section in a new way that is meaningful to future learning.

Extend: Allows students to conduct further research around an area of interest within the topic.

Assess: Provides strategies meant to inform students and teachers about the content and processes that have been learned.

Explore

The PSSM Teaching Principle states that, "Effective teaching requires a challenging and supportive classroom learning environment." In an ideal mathematical setting, students are able to think, ask questions, solve problems, and discuss solutions with their fellow classmates and the teacher. Teachers should provide students with worthwhile mathematical tasks in a way that is intriguing to all and challenging for students with different levels of ability. Mathematics teachers need to make decisions about when and how to provide information, and "how to support students without taking over the process of thinking for them." Knowing the best time to intervene is often determined by allowing students to ask questions and to explore concepts openly.

© Disney

Assess in Order to Guide Teaching: The Program Overview or the Discussion Starter on the DVD can be used to gauge students' prior knowledge. You can use student responses to make decisions about appropriate instruction and adaptations in order to meet the needs of individual students. Assessment can be in the form of student reflections from standards-aligned video clips or answers to questions found on the science quiz. Or, as in the following example, a simple graphic organizer can facilitate a formative assessment.

Example: Graphic Organizer (page 18) from *Measurement*

1. Explain to students that as they watch clips of the Bill Nye DVD Measurement, they will be filling in a graphic organizer. Begin by having the student place a circle in the middle of a piece of paper with the phrase "metric system" in it. The circle should have two or three "spokes" coming out of it.

2. Explain to students that as they watch a clip, they should display information on the wheel in a way that makes sense to them .

3. Students can then color code their graphic organizer so that one color represents what they already know about the metric system (e.g., meter, liter, gram, etc.) and another color represents new things they have learned from watching the video clip (e.g., how a meter was first determined, etc.) Replay the clip as necessary to allow students to review sections of interest.

4. Once students have completed their graphic organizers, ask them to share what they coded as "new" information. Write these on the board. Have students write their own "working" definition of the metric system. Once students have completed their definitions, collect and review their work to assess prior knowledge.

Conduct direct vocabulary instruction in the Explore phase. Research suggests that:

- Students must encounter words in context more than once to learn them.
- Instruction in new words enhances learning those words in context.
- One of the best ways to learn a new word is to associate an image with it.
- Direct vocabulary instruction on words that are critical to new content produces the most powerful learning.

Use the DVD Glossary with the linked video clips to expose students to new vocabulary words in context, along with associated video images. You can also find a printed version of the glossary terms in this Guide on page 21.

© Disney

Example: Using the Glossary for Direct Vocabulary Instruction
Measurement

1. Present students with a brief explanation or description of the new term or phrase from the glossary. For example: "Hodometer: a measuring wheel that was an instrument used in ancient Rome to measure distance traveled or mileage."
2. Present students with a nonlinguistic representation of the new term or phrase. Show the video clip associated with the term "hodometer."
3. Ask students to generate their own verbal description of "hodometer."
4. Ask students to create their own nonlinguistic representation of "hodometer."
5. Periodically ask students to review the accuracy of their explanations and representations.

Apply

"In planning individual lessons," the PSSM Curriculum Principle states that "teachers should strive to organize the mathematics so that fundamental ideas form an integrated whole. Big ideas encountered in a variety of contexts should be established carefully, with important elements such as terminology, definitions, notations, concepts and skills emerging in the process." Based on the information that you gained from the Explore assessments, design appropriate activities for your students. Check the experiments listed in the Episode Guide (see page 12) for explanations of the demonstration from the Bill Nye program as well as for additional experiments designed to help apply the knowledge gained.

In the following example from Measurement the standards based video clips are used to provide background information to the students.

Example: Understanding Relationships Among Units

1. Have students begin a graphic organizer with the word "Unit" in the circle, focusing on what they already know about units of measurement.
2. Watch the following chapters from the Bill Nye DVD *Measurement:*
   - A meter to a liter to a kilogram
   - Meter/centimeter/millimeter/micrometer
3. Complete the graphic organizer with new information from the clips.
4. Give students copies of the Student Problem Solving Sheet (see page 19) and have them fill the sheet out as they conduct their activities.
5. Do the activities entitled "What's a Centimeter on You?" and "How Much Can it Hold?" from the Measurement Episode Guide.
6. Write down any remaining questions that students have about units of measurements.

© Disney

Extend

Identify and Use Resources Outside of the School: "The school program must extend beyond the walls of the school." Each Bill Nye DVD contains resources designed to facilitate such understanding, including:

- Way Cool Scientist, found in both Watch Program and Bonus Materials, in which scientists discuss their current areas of study. This real-world connection often results in a deeper student understanding of a particular career.
- Disney's Edustation Web site, where relevant Internet links provide a starting point for students to further explore topics.
- Try these video clips, with activities parents and students can do at home. The questions generated by students from these experiences can be used as foundations from which they may conduct their own research.
- Standards-aligned video clips and Bill's demonstration video clips, which can help generate topics for further research. After viewing the clips, have students list their questions, perhaps about the most current developments in a topic. By conducting online or library research, students will find answers to their questions and will learn about a topic in greater depth.

"Problem solving is central to inquiry and application and should be interwoven throughout the mathematics curriculum to provide a context for learning and applying mathematical ideas" (NCTM, 2000). Challenging problems should be based on student interests and abilities so they explore mathematical concepts that are relevant to their lives. In the following example, students use measurement skills to solve a real life problem of local interest.

Example: Example: How Long Does it Take to Get Across My State?

Pose the question above to your students. Explain that their job will be to deterime how long it would take to traverse their state using a chosen mode of transportation. Students may choose from a variety of modes including, "walking", "skateboarding", or "riding a bike." Ask students for ideas of how to solve this problem without actually "going the distance."

Depending on their travel mode choice, students can use a stopwatch and a tape measure to determine the average speed they might go using their chosen mode. (This might need to be done as a homework assignment.) Using a map students should determine the route across the state they would like to take. Allow students to use many different routes. To vary the distances, suggest that students work with a state where they were born, or where they have once lived. Alternatively, students could expand this assignment to entire countries. Or the title could be changed to "How long does it take to get out of my state from my hometown?" for a real local context.

Once students have determined the time it would take to cross the state using their chosen mode, ask them to reconsider their answer and make it more realistic by adding time for sleep, rest, eating, etc. Instruct students to provide a rationale for these additions on the Student Problem Solving Sheet (page 19).

© Disney

Assess

Once students have solved the problem, you may choose to assess them in a number of different ways:

- By having students write about what they learned in a journal.
- By having students submit projects or reports.
- By having students take the program quiz to gauge their understanding of certain facts in the video. You can either print the quiz (found in this Guide on 23) and have each student complete it individually or use the DVD screen version and the scoring feature for whole-class assessment.
- By designing other standards-aligned questions to augment those that are provided.

While the quiz will provide you with information about what the students have learned, it does not assess how students have processed the information. Below you will find assessment ideas that can be used to measure both content and process.

A Sample Assessment

1. Explain to students that an important aspect of mathematics is communication. Tell students that they will write a short report on their problem from (How Long Does it Take to Get Across My State?) including:
   - The state and mode of transportation you chose including illustrations
   - The method that was used to find solutions to the problem
   - Mathematical calculations for solving the problem
   - Solution(s) to the problem
   - Additions to your solution to make it more realistic
   - Rationale for these additions
2. Distribute the rubric found in the Lesson Planning Worksheet (see page 16) to students so they know how they will be assessed. Make sure that students understand the criteria found in the rubric. Before you begin you may want to allow students to make changes to the rubric so that it is more clear or makes more sense from the their perspectives.

Allow students time to prepare their report. As students complete the report, walk around the room and ask questions to assess their progress and provide input as needed.

Congratulations! You have now completed the steps to set up a lesson plan using the Lesson Planning Worksheet. You have also explored many of the features of the Bill Nye DVD as well as the supplemental information found in this Teacher's Guide. And most important, you've made significant strides toward incorporating DVD technology into your day-to-day instruction.

© Disney

Principles and Standards for School Mathematics (NCTM)

Time

Standards/Benchmarks

Geometry Standard

Use visualization, spatial reasoning, and geometric modeling to solve problems

- Use geometric models to represent and explain numerical and algebraic relationships;
- Recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life.
- Use geometric models to solve problems in other areas of mathematics, such as number and measurement (3-5)

Measurement Standard

Understand measurable attributes of objects and the units, systems, and processes of measurement

- Understand relationships among units and convert from one unit to another within the same system;
- Select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles

Apply appropriate techniques, tools, and formulas to determine measurements

- Use common benchmarks to select appropriate methods for estimating measurements
- Solve simple problems involving rates and derived measurements for such attributes as velocity and density

Problem Solving Standard

- Monitor and reflect on the process of mathematical problem solving.

© Disney

Reasoning and Proof Standard

- Recognize reasoning and proof as fundamental aspects of mathematics;

Connections Standard

- Recognize and use connections among mathematical ideas;
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
- Recognize and apply mathematics in contexts outside of mathematics.

Representation Standard

- Create and use representations to organize, record, and communicate mathematical ideas;
- Use representations to model and interpret physical, social, and mathematical phenomena.

©Disney

Episode Guide

Time

Synopsis

In *Bill Nye the Science Guy: Time*, Bill Nye addresses the concept of time. What makes a day? Exactly where does a day begin and how do we know when it's over? Why do we measure time the way we do? Is it true that time can be measured only after it has passed?

Objectives

The student will:

- understand how the motion of the earth and moon relates to the measurement of time;
- explore the elements involved in the development of our present time system and the calendar that we use;
- become acquainted with the significances of the international date line, the 24 time zones, the equinox, and the principles of leap year;
- be introduced to the concept of the speed of light; and
- understand the principles of a sundial and learn how the rotation of the earth can be used to measure time.

Background Information

Measuring Time

The Babylonians and Egyptians used sundials, or shadow clocks, to divide daylight into short, defined periods. The Egyptians used the water clock, or clepsydra, to measure time at night, and the Greeks designed fine astrolabes, now replaced sextants, to determine the altitude of the sun or other celestial bodies. Modern mechanical clocks date from the late Middle Ages.

Before the third century B.C. the clepsydra was used by the Greeks to indicate intervals of time, especially in the court system; later it functioned as a clock. Clepsydras were used in Rome, the Arab world, and China.

Accuracy in timekeeping was improved considerably when the Dutch scientist Christiaan Huygens introduced the pendulum.

During the 16th and 17th centuries, the demand for accurate timekeeping devices for navigation at sea stimulated the development of portable timepieces.

International Date Line

The international date line is an imaginary line that runs approximately along the 180 degree meridian in the Pacific Ocean. A day is considered to begin immediately west of the line and to end immediately east of it. Therefore, the time zones on each side are 24 hours apart. Those who cross the line from west to east repeat one day, while those traveling the reverse course omit one day.

Equinox

Equinox means equal time of day and night. In the Northern Hemisphere the vernal, or spring, equinox occurs about March 21, and the autumnal equinox occurs about September 23. In the Southern Hemisphere the seasons are reversed.

© Disney

Preview Questions

- How long does it take the earth to travel one full rotation on its axis? How long to travel one full rotation around the sun?
- How often does the moon circle the earth?
- Where on earth does a day begin? Where on earth does a day end?
- Is it possible to keep accurate time without the use of a clock?
- What does your shadow have to do with the passing of time?
- Is time kept the same way all over the world?

Post Viewing Questions

- What is time? How do we measure it?
- What does the movement of the earth and the moon have to do with time?
- What is a time zone and why do we have them?
- If you did not have a watch, how could you measure time?
- Can the speed of time change?
- Why is it that two pendulums, released at the same instant but swinging at different speeds, will cross a midpoint at the same time? (Because of gravity.)
- Why does leap year happen only every four years? (Because about a quarter rotation of the earth is gained every year, which accounts for an extra day every four years.)
- As light travels, does it ever speed up or slow down? (No. It always travels at 300,000 km per second.)
- In Einstein's thought experiment, why does time pass more slowly for one brother?
- Explain the problem that scientist Andrew Mishkin was having with time on his Mars robot. How would you deal with this problem?

Suggested Activities

1. Celebrate Your Birthday Twice

Use this activity to strengthen students' understanding of the international date line (IDL).

Ask each student to plan an imaginary birthday celebration that could last for more than 24 hours yet still occur entirely on his or her actual birthday. It's possible only if you cross the IDL. Have students consult a world map that accurately represents the international date line (those with Internet access can visit http://www.worldtimezone.com/). Then each student should identify two specific locations and the time of the birthday bash at each place; provide directions for getting from place to place, including estimated travel time and other details; and explain why he or she chose those particular locations.

2. Time Around the World

Have students consult a world map that accurately represents the international date line (those with Internet access can visit http://www.worldtimezone.com/).

© Disney

Tell students to select four or five time zones from various regions of the world and create a social calendar of events that might be simultaneously occurring in those time zones. For example, while folks in Hong Kong are breakfasting, people in Honolulu would be having lunch, students in Chicago might be playing in an afterschool basketball game, and it would be bedtime in Greenland.

3. Calendars Over Time

Have students research and make calendars in the style of another culture. Some civilizations to investigate include: Mayan, Indian, Aztec, Greek, Roman, Mesopotamian, Chinese, Islamic, Babylonian and Hebrew.

What was the culture's calendar based on: the sun, the stars, etc? What is our calendar based on? How are these different? How are they the same?

Students should be creative and try to use a medium that best represents the origin of the calendar. Display the calendars in a school hallway or other prominent spot.

4. The Earth Rotates

In this activity for younger students, divide students into groups of four or five. Direct each group to actively portray the rotation of the earth, its orbit around the sun, and the moon's orbit around the earth. The portrayal should explain the concept of time. Group presentations can include a play, a physical demonstration, a song, a dance, or some other creative method.

5. Make an Hourglass

Have students work in pairs to create an hourglass (or perhaps a five minute glass). Here's how: Place sand in a plastic liter bottle; tape a second bottle to the first so the sand can flow from one to the other. Keep track of how long it takes for all the sand to pour through the bottleneck. Add or remove sand until the timer accurately measures the desired length of time.

Students can use their homemade timer when playing games, taking turns, or doing chores.

6. Design a Sundial

Challenge your students to research, design, and build a sundial that actually works. Provide toothpicks, wooden skewers, sheets of cardboard or foamcore, and modeling clay. Allow students to select whichever materials they want as they create a device with a measurable shadow. Encourage them to experiment with various configurations before determining which direction the numeral 12 should face, the angle at which to place a stick or other marker, and the distance between the numbers.

Have students use a commercial clock to check their sundials for accuracy. If they're not synchronized, have students figure out why and fix the problem.

7. How Long Is 30 Seconds?

Have students work in pairs to guess how long 30 seconds is, as demonstrated in the video. Have one person use a stopwatch while the other, without looking, indicates when he or she believes 30 seconds has passed.

Extend this activity by having students estimate the time that it would take, or how long it just took, for certain actions or events to occur. For example, how long would it take to sharpen a pencil or see a physical difference in an ice cube? Discuss what it means to have a good sense of time. How might someone improve his or her sense of time?

© Disney

8. Time Zones

Have students estimate the number of time zones in each of the seven continents, then have them consult an atlas or world map to find the correct answers. (For an accurate online world map divided into time zones, visit http://www.worldtimezone.com/.)

Next, have students make a map of each continent showing all time zones. Which continent has the most time zones? Which has the fewest? Ask students to consult published maps again to determine which ocean covers the highest number of time zones.

9. How Long Will It Take?

Have students contemplate and calculate the following: If it was powerful enough to do so, how long would it take a beam of light to travel around the world along the equator?

Students will need to find out the distance around the earth at the equator (40,075 km or 24,902 miles). They will also need to know the speed of light (300,000 km per second). To calculate how fast a light beam would travel around the world, students should divide the earth's equatorial circumference by the speed of light.

10. Why Does It Do That?

Why doesn't the international date line follow the 180th meridian exactly? Let your students consult various sources to find out. (The 180th meridian has been altered to avoid having two different calendar days occur simultaneously in one country. In the Northern Hemisphere, the IDL shifts east so that Siberia is in an Asian time zone; it shifts to the west so that all of the Aleutian are in one time zone.

Bibliography

Books

Aventi, Anthony F. *Empire of Time: Calendars, Clocks, and Cultures.* Basic Books, 1989.

Gardner, Robert. *Experimenting With Time*. 1995.

Branley, Franklyn. *Keeping Time: From the Beginning and Into the 21st Century*. 1993.

Barnett, Jo Ellen. *Time's Pendulum: The Quest to Capture Time–From Sundials to Atomic Clocks*. 1998.

Internet Resources

CNN World Time
http://www.cnn.com/WEATHER/worldtime/

Use the world time map to calculate the time around the world.

World Time Zone
http://www.worldtimezone.com/

Discover where the time zones are located and see the current time around the world.

The Time Zone Page
http://www.mich.com/~timezone/

The current time is available for 620 cities, worldwide.

The Autumnal Equniox
http://www.stcloud.msus.edu/~physcrse/astr106/emapautumn.html

An explanation of the equniox with links to related data and coordinates.

© Disney

Bill Nye the Science Guy

Lesson Planning Worksheet

Lesson Title _____

Objectives _____

_____

_____

Estimated Time Required _____

Materials Needed _____

_____

Principles and Standards for School Mathematics

_____

_____

_____

_____

_____

Explore _____

_____

_____

_____

Apply _____

_____

_____

_____

Extend _____

_____

_____

_____

© Disney

Assess

As presentations are made, assess the quality of the student's work as thoroughly and as equitably as you possibly can. The following criteria can be used to assist in your assessment.

Name of Student _____

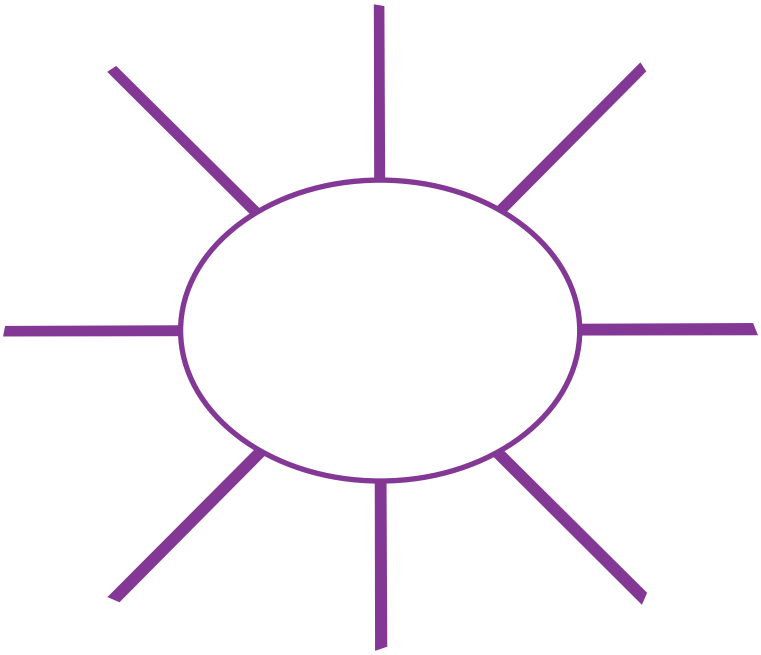
Question Investigated _____

Methods and Calculations for Finding Solutions			
1 Students do not report methods or calculations.	2 Students report methods or calculations but they are vague and incomplete.	3 Students report methods and calculations for solving the problem that are mostly complete.	4 Students report methods that are accurate and complete.
Solutions and Rationale			
1 Solutions are undefined. Rationale is not included.	2 Student solutions are incomplete and do not adequately answer the problem. Rationales are inaccurate.	3 Student solutions are complete and adequately answer the problem but rationale for additions are incomplete.	4 Student solutions are complete and include several detailed rationale for additions of time.
Illustrations			
1 Illustrations are not included.	2 Illustrations are adequate but do not connect well with the problem and solution.	3 Illustrations are integral to the problem and solution.	4 Illustrations are exceptional and visually engaging.

© Disney

Graphic Organizer

As you watch the Bill Nye clip, write down the main idea in the center of the circle. As supporting ideas are presented write additional words or phrases on the spokes.



© Disney

Student Problem Solving Sheet

Problem Title: _____

Problem: _____

_____

_____

Method: (How you plan to solve the problem)

_____

_____

_____

_____

_____

_____

Calculations: (Solve the problem, show your work)

© Disney

Illutstrations: (draw a picture)

What have you learned?:

© Disney

Glossary

Time

Fold and cut to use as flashcards.

Bill Nye the Science Guy

AXIS

Axis

An axis is an imaginary straight line about which an object rotates. Earth rotates on its axis once every 24 hours.

Bill Nye the Science Guy

TIME ZONE

Time Zone

A time zone is a geographic region designated by meridians (or imaginary lines of longitude) that shares the same time. To establish a global system of standard time, the Earth has been divided into 24 time zones, each 15 degrees longitude and one hour apart from the next zone.

Bill Nye the Science Guy

INTERNATIONAL DATE LINE

International Date Line

The International Date Line is an imaginary line running approximately along the 180th meridian that designates the starting point of each calendar day immediately west of the line. To the east of this line, the date is considered to be one day earlier.

Bill Nye the Science Guy

SUNDIAL

Sundial

A sundial is an instrument used to estimate time during daylight hours. It shows the time of day by the shadow cast from a straight-edged object on a marked disk. As the Earth turns, the shadow moves.

© Disney

Fold and cut to use as flashcards.

Bill Nye the Science Guy

EQUINOX

Equinox

Equinox, *meaning equal night,* refers to the two times of the year when the sun crosses the equator causing the length of days and nights to be the same all over the world. The equinoxesoccur around March 21st and September 23rd.

Bill Nye the Science Guy

LEAP YEAR

Leap Year

A leap year is a calendar year containing 366 days, with the additional day usually designated as February 29th. Because it takes the Earth about 365 days to orbit around the sun, a leap year is added approximately every 4th year to align the calendar with Earth's seasons and motions.

Bill Nye the Science Guy

PERIOD

Period

Period refers to a portion of time that is measured by some repeating event, such as a swinging pendulum. A period is determined by the amount of time it takes for a motion or event to complete a cycle and begin a new one.

Bill Nye the Science Guy

SPEED OF LIGHT

Speed of light

The speed at which all electromagnetic radiation (including visible light, radio waves, X-rays, ultraviolet radiation, etc.) travels in a vacuum, without interference of any matter, is a constant 299,792,458 meters per second.

© Disney

Name _____ Date _____

Quiz

Time

True or False? Circle T or F

1. The Earth moves around the sun in about one month. T or F

2 Because the Earth turns (rotates) once a day in 24 hours, there are 24 time zones. T or F

3. When released at the same time, two pendulums moving at different speeds will cross the middle point at the same time. T or F

4. When traveling close to the speed of light, time speeds up. T or F

5. The speed of light never changes, regardless if it is traveling toward you or away from you. T or F

Multiple Choice: Circle the letter of the best answer

6. Which of the following is used to measure time?
   - A. Sundial
   - B. Clock
   - C. Watch
   - D. All of the above

7. If someone throws you a ball from a truck moving toward you, then …
   - A. The speed of the ball, when you catch it, is the sum of the speed of the truck and the speed at which the ball was thrown.
   - B. The speed of the ball, when you catch it, can be calculated by subtracting the speed of the ball from the speed of the truck.
   - C. The speed of the ball is the same as the speed of the truck.
   - D. The speed of the ball is twice the speed of the truck.

8. In the Northern Hemisphere, which direction does the shadow on a sundial move?
   - A. Clockwise
   - B. Counterclockwise
   - C. Up and down
   - D. All of the above

9. How much time does it take for light to travel from the Earth to Mars?
   - A. 1-2 seconds
   - B. 3 minutes
   - C. 10-11 minutes
   - D. 5 hours

10. During which time of the day are shadows the shortest?
    - A. Morning
    - B. Noon
    - C. Afternoon
    - D. Midnight

© Disney

Answer Key

Time

1. F	4. F	7. A	9. C
2. T	5. T	8. A	10. B
3. T	6. D		

SPEED OF LIGHT

© Disney